FIREBERD 6000 REFERENCE MANUAL ADDENDUM

February 1998

50-14956-01 Rev. D

INTRODUCTION

This addendum incorporates changes into the Revision L *FIREBERD 6000 Reference Manual*, 50-12120-01, for Revisions P, P.2, R and R.1 FIREBERD 6000 software. Revision P.2 provides inverse ARP capability to the FIREBERD 6000 Frame Relay Option. Revision R provides functionality for the 2M/34M ATM Data Interface Module (Model 31650). Revision R.1 includes Frame Relay capability for the High Speed Serial Interface Module (Model 42219A).

FRONT MATTER

Make the following changes to the front matter of the reference manual.

Change the Software Level to R.1 in the upper right corner; change the date in the middle of the page to the date the changes are made to the manual; and change the revision level to Rev. R.1. Change the Software Revision level statement to "Software Revision R.1".

SECTION 2 INSTRUMENT DESCRIPTION

Make the following changes to Section 2, Instrument Description.

Pages 2-68 through 2-71, Table 2-2 Status-Select Auxiliary Functions:

Add the following note to Receiver Action On Synchronization Loss (AUX 03) after the CONT paragraph:
This auxiliary function does not apply to results made available by the Frame Relay Option.

Add the following note to Single Transmit (AUX 04) after the disabled in self-loop mode paragraph:
When the Frame Relay Option is enabled, one frame will be transmitted each time **RESTART** *is pressed.*

Add the following note to Out-of-Band Flow Control (AUX 08), In-Band Flow Control (AUX 09), and Sync Loss Threshold (AUX 10): This auxiliary function is not available when Frame Relay is enabled.

Add the following note to Block Length (AUX 30): This auxiliary function is not applicable to Frame Relay operation.

Add the following note to Signal Delay (AUX 31): Start and stop parameters that reference patterns are not valid when Frame Relay is enabled.

Page 2-105 replace the first step of the Frequency Deviation Stress Test with the following: Set **GEN CLK** *to SYNTH.*

SECTION 4 REMOTE CONTROL

Make the following changes to Section 4, Remote Control.

Page 4-6, please replace the IEEE-488 Interface DIP switch settings with the following: SW4:16, SW5:8, SW6:4, SW7:2 and SW8:1.

Page 4-74, please replace the RESULT:HOLD[ON\OFF] remote control command with the following: RESULT:HOLD. The on/off extensions are not required. The previous results in the buffer are overwritten by the current results whenever this command is invoked.

Page 4-95, Figure 4-5 Line Summary Register Group:

Replace Figure 4-5 with the following:

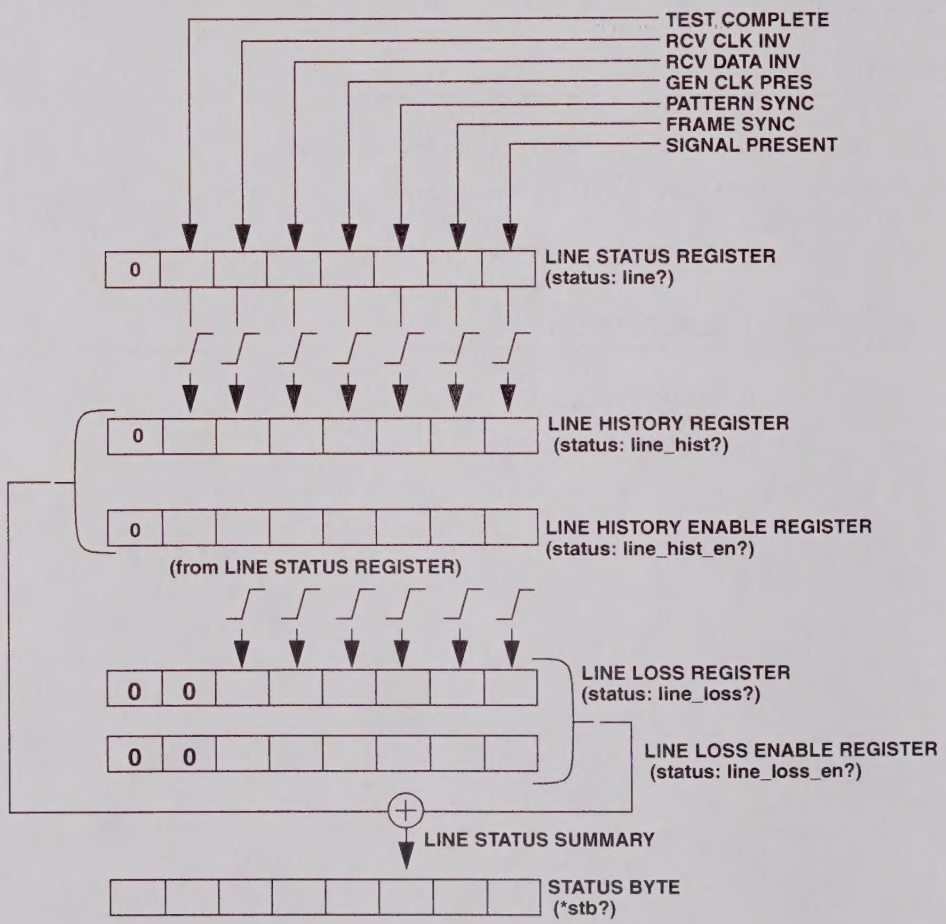

Figure 1. Figure 4-5 Line Summary Register Group

Page 4-96, The Line Loss Register Subsection:

Replace the definition of Bit 5 with the following: "Rx Overrun." This indicates the frame relay option receiver has overflowed since this register was last read.

Replace the definition of Bit 4 with the following: "Tx Underrun." This indicates the frame relay option receiver has underflowed since this register was last read.

SECTION 5 OPTIONS AND ACCESSORIES

Make the following change to Section 5, Options and Accessories:

On page 5-11, replace the description of cable, Model 40601 with the following: Bantam plug (dual) to RJ48C (10').

APPENDIX F

Replace entire Appendix F with the attached pages.

APPENDIX F FRAME RELAY

F.1. OVERVIEW

Frame relay is a packet-mode service with high throughput and low delay characteristics. Unlike other packet switching technologies, frame relay completely eliminates all processing at Layer 3 (Network Layer) of the OSI Reference Model and performs only a portion of the traditional Layer 2 (Data Link Layer). Since frame relay has no error correction capabilities, it must be implemented in relatively error-free networks to ensure high throughput.

The Frame Relay option is supported in FIREBERD 6000 equipped with Rev. K software and higher. The option allows you to perform Physical Layer analysis of the network by verifying the circuit is able to support frame relay operation.

The Frame Relay option provides the ability to collect basic protocol statistics about the frame relay circuit under test. These protocol statistics include:

Frame Count
Framed Octet Count
Errored Frame Count
Aborted Frame Count
Frames with the FECN Bit Set
Frames with the BECN Bit Set
Frames with the DE Bit Set
Average Utilization
Maximum Utilization
Average Throughput
Maximum Throughput

These statistics can be collected on one specific DLCI or on the aggregate of all DLCIs.

With the Frame Relay option installed and the 12 FRAME RELAY Auxiliary Function enabled, the FIREBERD 6000 can turn up a frame relay link and then perform frame relay WAN protocol testing up to 2048 kb/s (higher rates with data communication interfaces).

The Frame Relay option provides ICMP (Internet Control Message Protocol) Ping capabilities, enabling in-service connectivity testing and round trip delay measurements. In addition, InARP (Inverse Address Resolution Protocol) functionality is added to the Ping capability. This enhancement allows the user to analyze the circuit and report the IP address of the device at the far end of the Permanent Virtual Circuit (PVC).

The Frame Relay option also allows the FIREBERD 6000 to generate frame relay loads with varying stress parameters. Frame relay parameters that can be varied include:

Frame Size
Throughput
Transmission Pattern (Constant or Bursty)

The following interface modules are supported by the Frame Relay option.

Model:	Description:
INT232	Internal RS-232 Interface
40202	V.35/306 DTE/DCE Interface
40200	RS-449 (422/423) DTE/DCE Interface
42522	V.35/306/RS-449/X.21 DTE/DCE Interface
41400	RS-449/530/MIL Interface
30678/A	DDS DS0A/B Interface
41131/A/B	DDS Local Loop Interface
41440A	T1/FT1 Interface
40540	DS1/T1/D4/ESF/SLC-96 Interface
30608	CCITT G.703 64 kb/s Interface
30609	CCITT G.704 2048 kb/s Interface
41800	CCITT 2.048M/Nx64 kb/s Interface
40204	Lab (TTL) Interface
42219A	High Speed Serial Interface (HSSI) (requires software Rev. R.1 or higher)

To monitor a link, the selected interface must be connected as a DTE or DCE (DTE only with the 42219A interface) with the transmitter disabled (select RX only, not TX/RX, from the top level menu). The link being monitored can only be monitored in one direction (either DTE or DCE).

A special Y-cable (Part No. 43013-01) is required when using V.35 connections. This Y-cable disables the transmit functions during monitor mode and allows the user to select the direction in which frame relay traffic is to be monitored.

F.2. INSTALLING THE FRAME RELAY OPTION

The Frame Relay option is a factory-installed option. Have the Frame Relay option installed in the FIREBERD 6000 at the time of purchase, or have the Frame Relay option installed as a factory retrofit. Retrofitting a FIREBERD 6000 requires one or more of the following assemblies to be replaced or upgraded:

Data Generate & Receive board
EPROM card (Rev. K or higher software)
Processor board

F.3. SELECTING THE FRAME RELAY OPTION

The following paragraphs describe the process for selecting the Frame Relay option and configuring the 12 FRAME RELAY auxiliary function to test frame relay circuits.

F.3.1 Frame Relay Menu

Press the **MENU** switch until the AUXILIARY LED illuminates. With the AUXILIARY FUNCTIONS menu displayed, press the LIST softkey to view the available auxiliary functions. Press the FWD (forward) softkey until the 12 FRAME RELAY auxiliary function appears. Then press the SELECT softkey to display the Frame Relay top level menu as shown in Figure F-1.

As an alternate way of enabling the Frame Relay option (once the AUXILIARY LED illuminates), press the 1 and 2 keypad keys and press **ENTER** to select Auxiliary Function 12.

NOTE

When the Frame Relay option is enabled, BER analysis, pattern selection, and LUP are disabled. However, you can still perform other measurements (e.g., CRC errors, BPVs, Signal level, etc.).

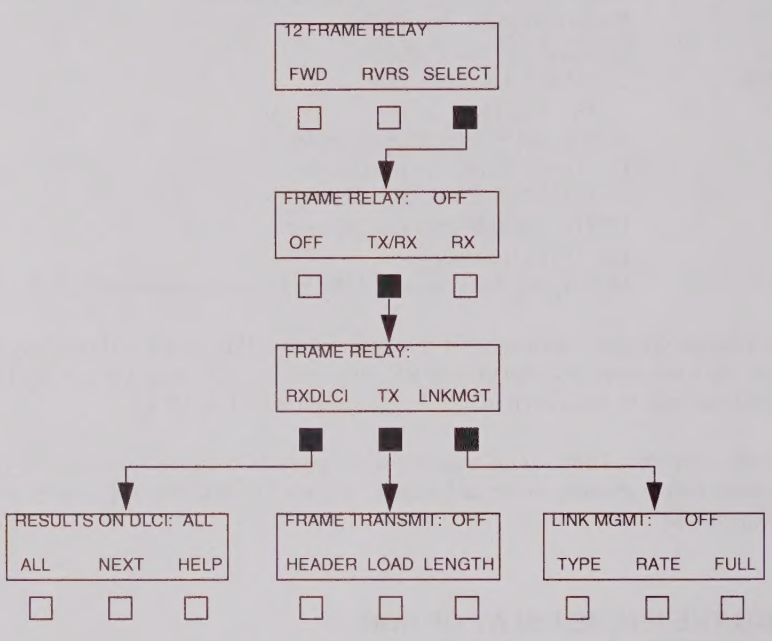

Figure F-1. Frame Relay Top Level Menus

Setting the 12 FRAME RELAY auxiliary function to ON backlights the AUX FUNC IN USE label and displays the following menu selections for frame relay testing:

RXDLCI — Results On DLCI menu
TX — Frame Transmit menu
LNKMGT — Link Management menu

F.3.2 Results On DLCI Menu

Pressing the RXDLCI softkey displays the Results On DLCI menu, as shown in Figure F-2. The Results On DLCI menu allows you to specify either all DLCIs, one specific DLCI (0 to 1023), or the next highest DLCI to be monitored.

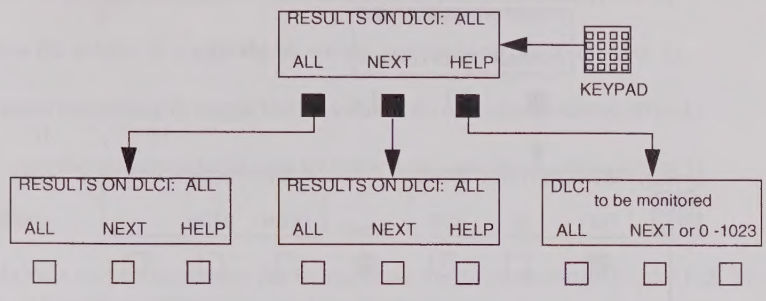

Figure F-2. Results On DLCI Menu

The Results On DLCI menu softkeys perform the following functions:

ALL — press the softkey to select all DLCIs to be monitored.

NEXT — the FIREBERD 6000 accumulates DLCIs from received frame headers and from the Full Status Link Management messages supplied by the network and stores them in a table. This softkey selects the next highest DLCI from that table to be monitored.

HELP — press the softkey to display the help information.

Keypad (0 to 9) — enter the specific DLCI (0 to 1023) to be monitored, then press ENTER. If you enter an invalid DLCI, the previously valid DLCI reappears.

F.3.3 Frame Transmit Menu

Pressing the TX softkey displays the Frame Transmit menu, as shown in Figure F-3. The Transmit Frame menu allows you to specify header data for the DLCI(s) being transmitted by the FIREBERD 6000 and the status of the bits in the address field. The Transmit Frame menu is controlled through the Frame Load menu.

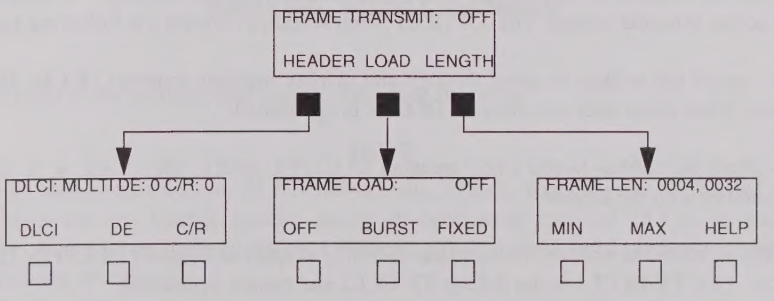

Figure F-3. Frame Transmit Menu

The Frame Transmit menu softkeys perform the following functions:

HEADER Softkey

Press the HEADER softkey to display the Header menu, as shown in Figure F-4. The Header menu selects the DLCI (single or multiple) being transmitted and sets the value of the DE, C/R, FECN, and BECN bits.

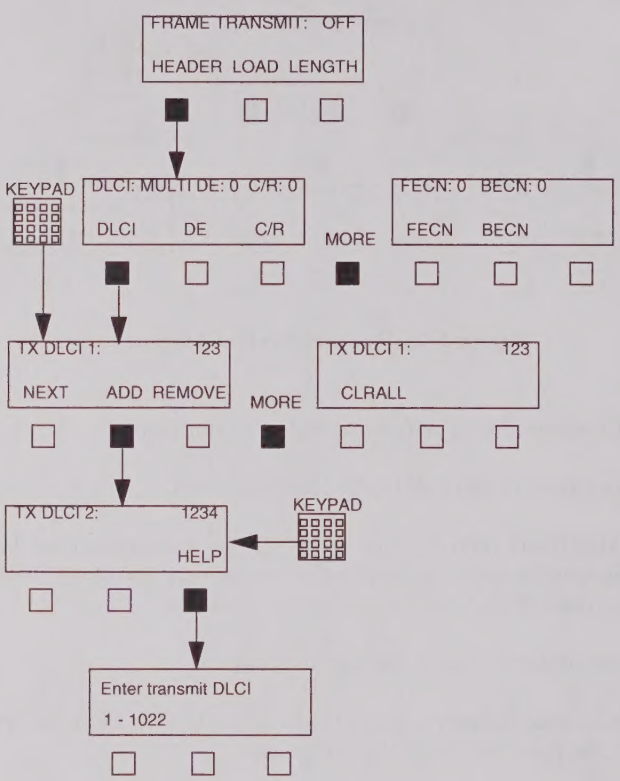

Figure F-4. Header Menu

The Header menu softkeys perform the following functions

DLCI — press the softkey to display the TX DLCI menu. This allows single or multiple DLCIs to be transmitted across multiple frames. The TX DLCI menu softkeys perform the following functions:

NEXT — press the softkey to scroll through and display multiple transmit DLCIs. The softkey is only functional when more than one transmit DLCI is programmed.

ADD — press the softkey to add a new transmit DLCI (`TX DLCI xx:, xx = 1 to 10`). Enter the DLCI number with the keypad.

REMOVE — press the softkey to delete the currently displayed transmit DLCI (`TX DLCI xx:, xx = 1 to 10`). TX DLCI 1 is the default TX DLCI and cannot be deleted.

CLRALL — press the softkey to clear all transmit DLCIs, except for TX DLCI 1. DLCI 1 defaults to DLCI number 25.

HELP — press the softkey to display the help information.

Keypad (0 to 9) — enter the specific DLCI (1 to 1023) to be transmitted to change the currently displayed transmit DLCI, then press ENTER. If you enter an invalid DLCI, the previously valid DLCI reappears.

DE — press the softkey to toggle the bit value to its opposite condition (0 or 1).

C/R — press the softkey to toggle the bit value to its opposite condition (0 or 1).

FECN — press the softkey to toggle the bit value to its opposite condition (0 or 1).

BECN — press the softkey to toggle the bit value to its opposite condition (0 or 1).

LOAD Softkey

Press the LOAD softkey to display the Frame Load menu, as shown in Figure F-5. The Frame Load menu allows you to specify the transmit channel loading type.

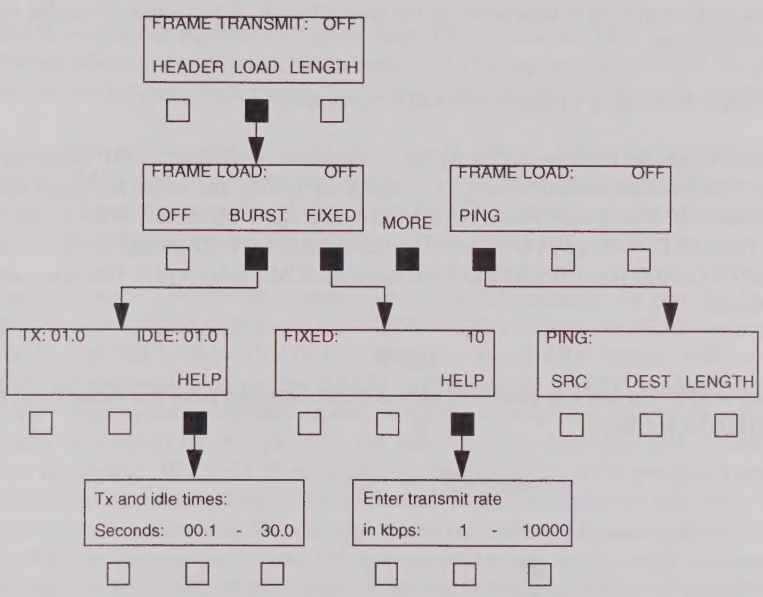

Figure F-5. Frame Load Menus

The Frame Load menu softkeys perform the following functions:

NOTE

For lost frame analysis, test DLCIs individually. Mainly because, the FIREBERD 6000 distributes the test frames equally across all configured transmit DLCIs. In addition, DLCIs often traverse the network over different physical paths causing transmitted frames to arrive out of sequence.

OFF — press the softkey to stop generating the frame load (except link management frames, if configured to do so).

BURST — allows you to specify the frame load burst transmit (TX) and idle (IDLE) times. Note that during the TX time, 100% utilization load is generated and 0% utilization is transmitted during the idle time. (Not functional with the 42219A interface).

Keypad (0 to 9) — enter the frame load burst transmit (TX) and idle (IDLE) times from 00.1 to 30.0 seconds, then press **ENTER**. If you enter an invalid time, the previously valid time reappears.

HELP — press the softkey to display the help information.

FIXED — allows you to specify a fixed information rate for transmission. The fixed rate is calculated over a 1-second interval (e.g., "10" transmits 10,000 frame bits per second over the line whether it is a T1 rate, 56k, etc.)

NOTE

Flags are considered overhead and are not included in the load. They are in addition to the load rate.

Keypad (0 to 9) — enter the frame load transmission rate from 1 to 10,000 kb/s, then press ENTER. The actual maximum load is dependent on the frame length. If you enter an invalid rate, the previously valid rate reappears.

HELP — press the softkey to display the help information.

PING — allows you to specify source, destination, encapsulation method, and IP datagram length, as shown in Figure F-6. This function enables in-service connectivity testing and round trip delay measurements to be performed between IP configured frame relay routers and the FIREBERD 6000 or between FIREBERD 6000s. The FIREBERD 6000 can PING an IP router or another FIREBERD 6000. An IP router can also PING a FIREBERD 6000 (the FIREBERD 6000 supplies ICMP echo reply). Changing any ping parameter causes a test restart.

NOTE

PING and InARP frames are sent only on the DLCI selected from the Results on DLCI Menu (RXDLCI softkey).

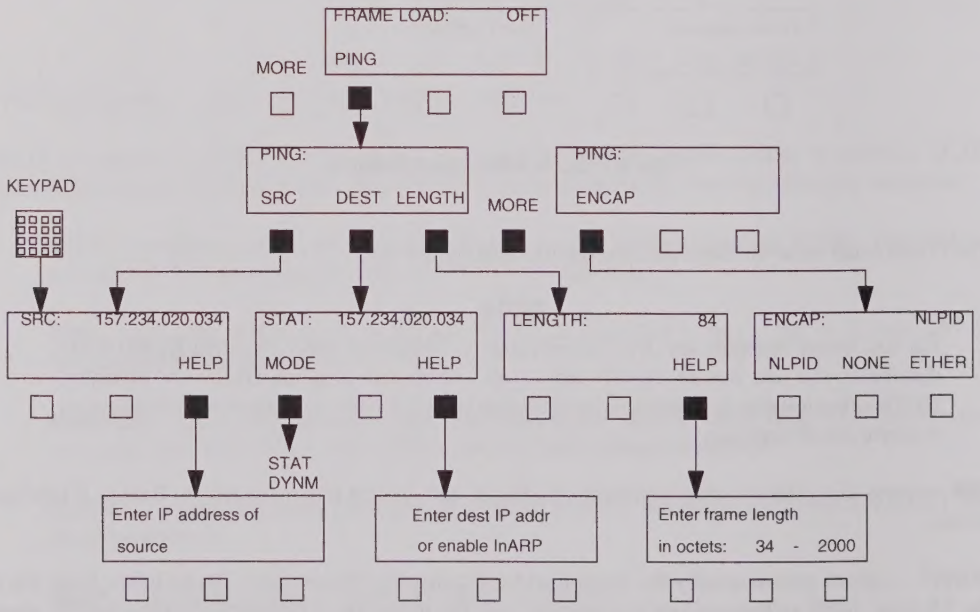

Figure F-6. PING Menu

The PING menu softkeys perform the following functions:

SRC — enter the IP source address of the ping-transmitting unit with the keypad (0 to 9), then press **ENTER**. The range for each address field is 000 to 255. If an invalid address is entered, the previous address reappears. This address is also used in response to received InARP requests.

DEST — enables automatic and manual selection of the IP destination address for the echo-reply unit. Manual selection is used when the IP address is known. When the IP source address is unknown, the InARP feature of Ping enables the user to generate and transmit a request to the far end device of any PVC and obtain its IP address. It also enables the far end device to request the FIREBERD's IP address. The IP address recovered is used as the destination address for PING. When selected, the softkey MODE displays.

MODE — controls automatic IP addressing. The options are STAT and DYNM for static (manual) address selection and dynamic (automatic) InARP selection, respectively. When pressed, this softkey toggles between these modes. The active mode appears on the top line of the MENU display.

Static mode enables manual selection of the IP address. Using the keypad, select an IP address, ranging 000 to 255 for each address field. The echo-reply unit source address must match the ping-transmitting unit destination address. Press **ENTER** to implement the new address. If the address is outside the range or invalid, the previous address is restored.

Dynamic mode enables the transmission of InARP requests. To send an InARP request, press MODE until DYNM appears in the MENU display. Select the DLCI for transmission from the Results On DLCI Menu (RXDLCI softkey) as the ***InARP request will be transmitted on the RXDLCI (transmit and receive DLCIs are linked for InARP functionality), see Figure F-2***. InARP requests are transmitted on one DLCI at a time and are not transmitted on DLCI 0 or 1023. If ALL is selected for the RXDLCI, the last configured receive DLCI is used. If a DLCI has not been configured, RXDLCI 25 is the default. Each time NEXT is pressed, a new InARP request is transmitted on the new DLCI. Once initiated, InARP requests are sent every five seconds until a valid response is returned. The message **`Sending InARP request`** appears on the MENU display when the initial request is sent. The message **`Waiting for InARP response`** appears on the ANALYSIS RESULTS display until a response is returned. Received InARP requests will always result in the generation of a response.

In summary, InARP requests are transmitted when one of the following conditions exists.

- *NEXT is pressed; the DLCI is not 0, 1023 or ALL; and dynamic mode is enabled.*
- *The receive DLCI is entered using the keypad; the DLCI is not 0, 1023 or ALL; and dynamic mode is enabled.*
- *Dynamic mode is toggled to DYNM; and the DLCI is not 0, 1023 or ALL.*
- *An InARP response was not received within five seconds of the last transmitted request.*

LENGTH — enter the IP packet length with the keypad (0 to 9), then press ENTER. The packet length controls the ping frame length which is padded with the "Quick brown fox..." message. The range for ping frame length is 34 to 2000. If you enter an invalid length, the previously valid length reappears.

ENCAP — select one of the following encapsulation formats for PING and InARP frames:

NONE — disables encapsulation.

NLPID — enables Network Layer Protocol Identification encapsulation according to RFC 1490.

ETHER — enables Ethertype only encapsulation.

HELP — press the softkey to display the help information.

LENGTH Softkey

Press the LENGTH softkey to display the Frame Length menu, as shown in Figure F-7. The Frame Length menu allows you to specify the minimum (4) and maximum (9999) frame length being transmitted. The frame length includes the header and the user data field but not the beginning and ending flags. This softkey is not applicable when LOAD is set to PING (there is a LENGTH softkey under PING).

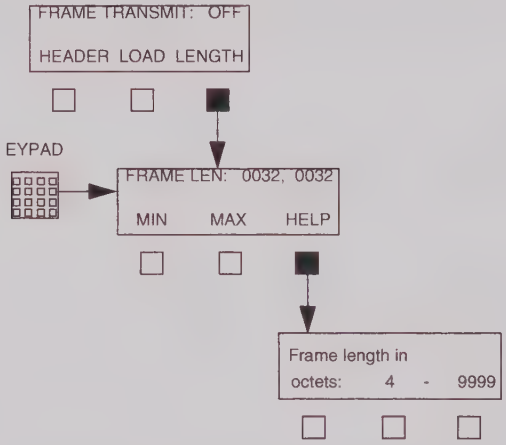

Figure F-7. Frame Length Menu

The Frame Length menu softkeys perform the following functions:

MIN — press the softkey to move the cursor under the most significant digit for the minimum frame length field (on the left). Enter the minimum information frame length (in octets from 4 to 9999) by using the keypad (0 to 9), then press **ENTER**. If you enter an invalid frame length, the previously valid frame length reappears.

NOTE

For lost frame analysis, the minimum frame length must be at least 16 bytes.

MAX — press the softkey to move the cursor under the most significant digit for the maximum frame length field (on the right). Enter the maximum information frame length (in octets from 4 to 9999) by using the keypad (0 to 9), then press **ENTER**. If you enter an invalid frame length, the previously valid frame length reappears.

HELP — press the softkey to display the help information.

NOTE

If you set the MIN value greater than the MAX value or set MAX to a value less than MIN, pressing **ENTER** automatically sets the MAX value equal to the MIN value setting. To transmit frames of equal length, set the MIN value equal to the MAX value.

F.3.4 Link Management Menu

Pressing the LNKMGT softkey displays the Link Management menu, as shown in Figure F-8. The Link Management menu allows you to specify the link management type, poll status rate, duration, and interface.

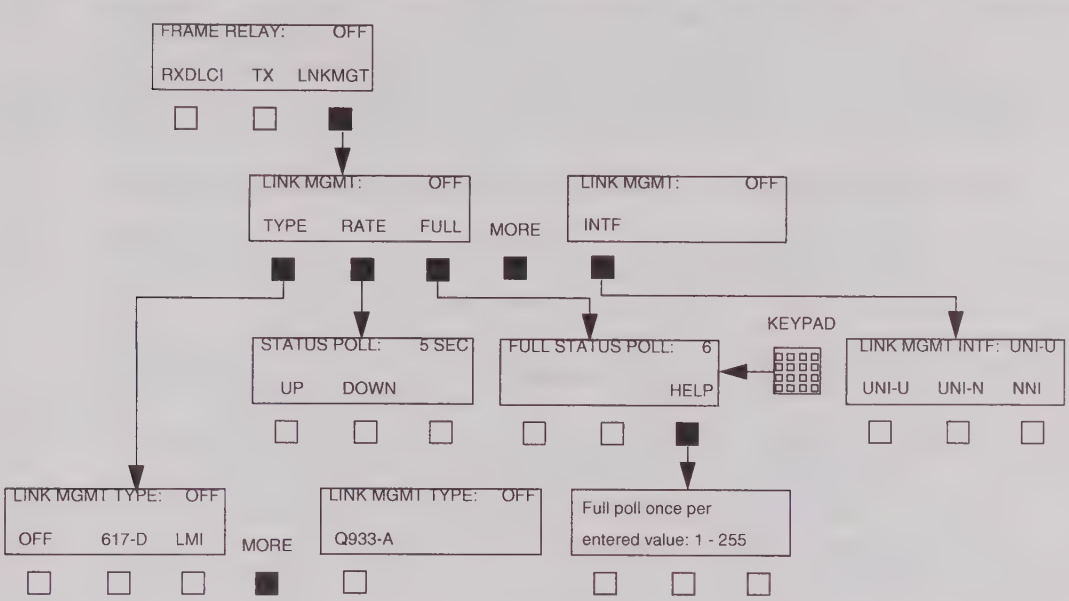

Figure F-8. Link Management Menu

The Link Management menu softkeys perform the following functions:

TYPE — press the softkey to display the Link Management Type menu. The Link Management Type menu allows you to select the type of link management to be used. The Link Management Type menu softkeys perform the following functions:

OFF — no link management is selected (Unsupported).

617-D — selects the ANSI T1.617 Annex D link management.

LMI — selects the frame relay consortium local management interface.

Q933-A — selects ITU (CCITT) Q.933 Annex A link management.

RATE — press the softkey to display the Status Poll menu. The Status Poll menu displays the time interval between "STATUS ENQUIRY" polls transmitted by the FIREBERD 6000 to the network. The Status Poll menu softkeys perform the following functions:

UP — press the softkey to increment the status poll interval from 5 to 30 seconds in 5-second steps.

DOWN — press the softkey to decrement the status poll interval from 30 to 5 seconds in 5-second steps.

FULL — press the softkey to display the Full Status Poll menu. The displayed value indicates the interval between full status enquiry polls (measured in the number of status polls). Setting this menu to 5 and the Status Poll menu rate to 10, causes a full status poll to be transmitted every 50 seconds.

Keypad (0 to 9) — enter the full status enquiry poll interval from 1 to 255, then press **ENTER**. If you enter an invalid time, the previously valid time reappears.

HELP — press the softkey to display the help information.

INTF — press the softkey to display the Network Interface menu. The Network Interface menu allows you to select the direction in relation to the network. The Network Interface menu softkeys perform the following functions:

UNI-U — press the softkey to select the user (DTE) side of the user-network interface.

UNI-N — press the softkey to select the network (DCE) side of the user-network interface.

NNI — press the softkey to select bidirectional network-network interface.

F.3.5 Frame Relay Status Indicators and Messages

The PATTERN SYNC LED indicates valid frame relay frames (on any DLCI) are being received. If no valid frames are received for 31 seconds then a synchronization loss is declared.

When the Frame Relay option is enabled, the BER analysis capability of the FIREBERD 6000 is not available. This means that pattern-related results (e.g., Bit Errors, BER, etc.) are not available when the Frame Relay option is active.

The messages `Receiver Overrun Error` and `Transmitter Underrun Error` occur when the Frame Relay system is receiving more frame relay traffic than can be processed, or is transmitting more traffic than can be processed, respectively. As a result, errored frames cannot be counted. To correct this, lower the rate at which the data is being transmitted to the FIREBERD 6000 and press the **RESTART** switch to clear the message.

All other indicators and switches are based on the current interface selected.

F.4. AVAILABLE FRAME RELAY RESULTS

The following ERROR and PERFORMANCE category results are provided when the Frame Relay option is enabled.

F.4.1 ERROR Category Results

The following test results appear in the ERROR Category.

TX PNG — number of ping packets/frames transmitted by the FIREBERD 6000. The result only appears when the transmit frame load is set to PING.

ECHO PNG — number of successful echo replies transmitted by the FIREBERD 6000. The destination address within the arriving ping packet must match the source address of the unit transmitting the echo reply. The destination address of the unit transmitting an echo reply can be blank or incorrect, it is irrelevant. When the 12 FRAME RELAY auxiliary function is enabled, the result is incremented in any mode.

LOST PNG — number of ping packets that were not echoed back to the FIREBERD 6000; including out of order echo reply packets and corrupted echo reply packets. The result is not used in delay calculations. The result only appears when the transmit frame load is set to PING.

FRM CNT — a count of the total number of frame relay frames detected (including errored and aborted frames). This result can be calculated across all DLCIs or for one specific DLCI.

FRM OCTS — a count of the total number of octets received in valid frame relay frames. This result can be calculated across all DLCIs or for one specific DLCI.

FRM RATE — the average number of frames per second received since the start of the test.

AVG FRM — the average frame size calculated as the number of FRM OCTS divided by the FRM CNT number. This result can be calculated across all DLCIs or for one specific DLCI.

FCS ERRS — a count of the valid frame relay frames which have FCS errors. This result is calculated across all DLCIs. The number of errored frames incrementing indicates that there is a Physical Layer impairment on the monitored link.

ABRT FRM — a count of the aborted frame relay frames detected (excluding out of frame aborts). This result is calculated across all DLCIs. An aborted frame indicates the frame has become all 1s and that the link is dead or the switch on the other end stopped a frame in the middle of its transmission.

SHRT FRM — a count of the valid frames that are less than 4 bytes long, excluding flags. This result is calculated across all DLCIs. The incrementing of short frames indicates a network equipment fault.

FECN FRM — a count of valid frames with the Forward Explicit Congestion Notification (FECN) bit set (i.e., 1). This result can be calculated across all DLCIs or for one specific DLCI. This result incrementing indicates that the network is detecting congestion along the PVC at the receiving DLCI. Reducing the transmission frame relay rate is recommended.

BECN FRM — a count of valid frames with the Backward Explicit Congestion Notification (BECN) bit set (i.e., 1). This result can be calculated across all DLCIs or for one specific DLCI. When this result is incrementing, it indicates that frames transmitted on the PVC, for which BECN is set, are either causing or encountering congestion. Reducing the transmitted frame load should help to alleviate the condition.

DE FRM — a count of valid frames with the DE bit set (i.e., 1). This result can be calculated across all DLCIs or for one specific DLCI. When this result is incrementing, it indicates that received frames are being marked as "discard eligible". This occurs because: 1) The far-end device is indicating that the frames can be discarded, or 2) The network is receiving frames from the far-end device at a rate that exceeds the committed information rate (CIR).

LOST FRM — a count of FIREBERD 6000 test frames that appear to have been lost by the network, based on gaps in the test frames sequence number. This result increments to indicate that frames are being dropped from the network. Frames are dropped by the network when the frame is errored (has an invalid FCS) or is discarded because of congestion or over-utilization. When generating frames on one DLCI, set the receive DLCI to the corresponding transmit DLCI to guarantee an accurate result. This result is not valid when the FIREBERD 6000 is transmitting on more than one DLCI.

LMI MSGS — the total number of LMI status or enquiry messages received since the start of the test if LMI INTF is UNI-U or UNI-N, respectively. An incrementing count for this result indicates a "heartbeat".

LMI ENQS — the number of LMI status enquiry messages received if LMI INTF is NNI.

LMI STAT — the number of LMI status messages received if LMI INTF is NNI.

LMI ERRS — the total number of LMI errors detected. LMI errors indicate that the receive sequence number is not equal to the last transmitted send sequence number. This result incrementing indicates that the link management handshaking is not operating correctly.

LMI TMOS — the number of LMI timeouts. Indicates nonreceipt of a STATUS message within a polling interval after a STATUS ENQUIRY has been sent. This result incrementing indicates that the link from your FIREBERD 6000 to the network switch is down, that the link from the switch to you is down, or that the switch is down.

NOTE

The LMI results are only available when the Link Management Type is set to LMI, 617-D, or Q933-A.

PVC STAT — the current status of the selected DLCI. This result is only available when one specific DLCI is analyzed. This is the status that the switch is reporting. The PVC STAT result can have the following possible values.

Result Value:	Meaning:
" "	DLCI is undefined
INACTIVE	DLCI is inactive
NEW	DLCI was just added
DELETED	DLCI was just deleted
RNR	DLCI status is RNR
ACTIVE	DLCI is active
NO STAT	DLCI is in use, but was not included in last status message

F.4.2 PERFORMANCE Category Results

The following test results appear in the PERFORMANCE Category:

MIN PNG — minimum round trip delay, in milliseconds, since the beginning of the test based on the time difference between a transmitted ping and a successfully received echo reply. Resolution is 100 µs. The result only appears when the transmit frame load is set to PING.

MAX PNG — maximum round trip delay, in milliseconds, since the beginning of the test based on the time difference between a transmitted ping and a successfully received echo reply. Resolution is 100 µs. The result only appears when the transmit frame load is set to PING.

AVG PNG — average round trip delay, in milliseconds, since the beginning of the test based on the time difference between a transmitted ping and a successfully received echo reply. Resolution is 100 µs. The result only appears when the transmit frame load is set to PING.

AVG%UTIL — the average percentage of link utilization on the received channel since the start of the test calculated as the number of FRM OCTS divided by the total number of octets received. This result can be calculated across all DLCIs or for one specific DLCI.

MAX%UTIL — the maximum percentage of link utilization on the received channel in any one second since the start of the test. This result can be calculated across all DLCIs or for one specific DLCI.

AVG TPUT — the average received throughput since the start of the test, calculated as total received User Data Field (UDF) bits divided by the total seconds. This result can be calculated across all DLCIs or for one specific DLCI. This result can be used to estimate the CIR.

MAX TPUT — the maximum received throughput during any one second since the start of the test. This result can be calculated across all DLCIs or for one specific DLCI.

F.4.3 Error Print Results

The FCS ERRS and ABRT FRM results are able to generate error prints.

F.4.4 Delta Print Results

The following results can appear in delta prints:

ABRT FRM
AVG%UTIL
BECN FRM
DE FRM
FCS ERRS
FECN FRM
FRM CNT
FRM OCTS
LOST FRM
MAX%UTIL

F.4.5 Results Prints

When the Frame Relay option is selected, the standard results print additionally prints the following results:

ABRT FRM
AVG TPUT
AVG%UTIL
FCS ERRS
FRM CNT
FRM OCTS
LOST FRM

All results are displayed for long result prints.

F.4.6 Histogram Results

The following are results that can be selected to generate a histogram print:

ABRT FRM
BECN FRM
DE FRM
FCS ERRS
FECN FRM
FRM CNT
FRM OCTS
LOST FRM

F.5. LINK LAYER ANALYSIS

Link Layer analysis is performed in a monitoring or link terminating configuration. This allows statistics on the frame relay to be collected. The Link Layer analysis capability enables you to:

- Accumulate the following Link Layer statistics computed across the entire bandwidth, or for a single DLCI that you specify:

  Total Frame Octets Received
  Total Frames Received
  Average Frame Size
  Frames with the FECN Bit Set
  Frames with the BECN Bit Set
  Frames with the DE Bit Set
  Errored Frames
  Aborted Frames
  Short Frames
  Average Throughput (kb/s)
  Maximum Throughput (kb/s)
  Average % Utilization
  Maximum % Utilization

F.6. LOAD GENERATION AND ANALYSIS

When used in a link terminating configuration, the Frame Relay option can transmit FIREBERD 6000 test frames according to load parameters that you specify.

This ability to generate test frames meets or exceeds the following requirements.

- Generates fixed length frames with a total length of between 4 and 9999 octets; or
- Generates random length frames within a minimum and maximum length, which you specify (4 to 9999 octets) (flags are not included in the length specified).
- Generates frames at a fixed utilization between 1 and 10,000 kb/s, in 1 kb/s increments with the load distributed over the full link capacity (flags are not included in the length specified).; or
- Generates frames with a bursty utilization, at 100% utilization for 00.1 to 30.0 seconds, then at a 0% utilization (idle) for 00.1 to 30.0 seconds.
- Generates frames for one or multiple DLCIs (1 to 10), allowing you to control the state of the FECN, BECN, DE, and/or C/R bits.
- Generates frames of sufficient length to conform with RFC 1490, with the Network Layer Protocol Identifier (NLPID) and Subnetwork Access Protocol (SNAP) header ID set to identify the frame as a FIREBERD 6000 test frame. The user data in generated frames consists of a sequential count (from 0 to 65536), and the remainder of the data is a fixed pattern. Generated frames that do not have a length sufficient to conform with RFC 1490 will be a truncated form of the standard test frame. Note that the Frame Relay option supports AUX 04 (Single Transmit Mode).
- Received FIREBERD 6000 test frames have their sequence number analyzed for lost frames (LOST FRM), in addition to the standard Link Layer analysis described previously. Lost frame analysis is only valid in single TX/RX analysis mode.

F.7. LMI ANALYSIS AND EMULATION

The Frame Relay option decodes Local Management Interface (LMI) messages to provide PVC and link status information in the form of LMI results. LMI messages are available whether in monitoring or terminating configurations.

In terminating configurations, LMI emulation can be configured for the user or the network side of the UNI, or for the NNI. The LMI analysis/emulation capability meets or exceeds the following requirements:

- Supports either ANSI T1.617 Annex D, the Frame Relay Forum scheme (optional extensions are not presently supported), or ITU Q.933 Annex A.
- Provides a user-selectable heartbeat polling (from 5 to 30 seconds), in 5-second increments.
- Provides a user-selectable full status polling interval (from 1 to 255 poll cycles).
- Provides the following LMI-derived results:

  LMI MSGS
  LMI ERRS
  LMI TMOS
  PVC STAT
  LMI ENQS (NNI mode only)
  LMI STAT (NNI mode only)

F.8. REMOTE CONTROL COMMANDS

Remote control commands used to control the Frame Relay option are described in the following paragraphs. The FIREBERD 6000 adheres to the IEEE-488.2 remote control syntax.

AUX:FRAME_RELAY OFF
Turns off the Frame Relay option.

AUX:FRAME_RELAY ON
Turns on the Frame Relay option.

AUX:FRAME_RELAY TX_RX
Places the Frame Relay option in Transmit/Receive (Emulation) mode.

AUX:FRAME_RELAY RX
Places the Frame Relay option in Receive-Only (Monitor) mode.

AUX:FRAME_RELAY?
Requests the status of the Frame Relay option.

AUX:FRAME_RELAY:BURST_TIME xxx
Sets the burst time in tenths of a second (where xxx = 001 to 300).

AUX:FRAME_RELAY:BURST_TIME?
Requests the current burst time selection.

AUX:FRAME_RELAY:DLCI_MON xxxx
Selects the DLCI to be monitored (where xxxx = All, NEXT, or 0 to 1023).

AUX:FRAME_RELAY:DLCI_MON?
Requests the DLCI being monitored.

AUX:FRAME_RELAY:FIXED_RATE xxxxx
Sets the fixed rate, in kb/s (where xxxxx = 1 to 10000).

AUX:FRAME_RELAY:FIXED_RATE?
Requests the fixed rate selection.

AUX:FRAME_RELAY:HEADER:BECN [OFF | ON]
Sets the BECN bit (where OFF = 0 and ON = 1).

AUX:FRAME_RELAY:HEADER:BECN?
Requests the BECN bit value.

AUX:FRAME_RELAY:HEADER:CR [OFF | ON]
Sets the C/R bit (where OFF = 0 and ON = 1).

AUX:FRAME_RELAY:HEADER:CR?
Requests the C/R bit value.

AUX:FRAME_RELAY:HEADER:DE [OFF | ON]
Sets the DE bit (where OFF = 0 and ON = 1).

AUX:FRAME_RELAY:HEADER:DE?
Requests the DE bit value.

AUX:FRAME_RELAY:HEADER:DLCI nn, xxxx
Sets the DLCI header (where nn = 1 to 10 and xxxx = 0 to 1023).

AUX:FRAME_RELAY:HEADER:DLCI? nn
Requests the DLCI header number.

AUX:FRAME_RELAY:HEADER:DLCI_ADD xxxx
Adds a new transmitted DLCI (where xxxx = 0 to 1022).

AUX:FRAME_RELAY:HEADER:DLCI_num?
Requests number of DLCI entries.

AUX:FRAME_RELAY:HEADER:DLCI_REMOVE nn
Removes DLCI entry (where nn = 1 to 10).

AUX:FRAME_RELAY:HEADER:FECN [OFF | ON]
Sets the FECN bit (where OFF = 0 and ON = 1).

AUX:FRAME_RELAY:HEADER:FECN?
Requests the FECN bit value.

AUX:FRAME_RELAY:IDLE_TIME xxx
Sets the idle time, in tenths of a second (where xxx = 001 to 300).

AUX:FRAME_RELAY:IDLE_TIME?
Requests the current idle time selection.

AUX:FRAME_RELAY:LNKMGT [OFF | 617-D | LMI | Q933-A]
Sets the link management type (where OFF = none, 617-D = ANSI T1.617 Annex D, LMI = Frame Relay Forum, and Q933-A = Q.933 Recommendation).

AUX:FRAME_RELAY:LNKMGT?
Requests the frame relay link management type.

AUX:FRAME_RELAY:LNKMGT:FULL xxx
Sets the number of full LMI status polls that are sent (where xxx = 001 to 255).

AUX:FRAME_RELAY:LNKMGT:FULL?
Requests the number of full LMI status polls that are to be sent.

AUX:FRAME_RELAY:LNKMGT:INTF [UNI-U | UNI-N | NNI]
Sets the link management interface type (where UNI-U = User Network Interface - User Side, UNI-N = User Network Interface - Network Side, and NNI = Network-Network Interface).

AUX:FRAME_RELAY:LNKMGT:INTF?
Requests the link management user network interface type.

AUX:FRAME_RELAY:LNKMGT:POLL xx
Sets the frequency (how often) LMIs are sent, in seconds (where xx = 5 to 30, dividable by 5).

AUX:FRAME_RELAY:LNKMGT:POLL?
Requests the LMI poll interval time.

AUX:FRAME_RELAY:MAX_LENGTH xxxx
Sets the maximum frame relay length (where xxxx = 4 to 9999).

AUX:FRAME_RELAY:MAX_LENGTH?
Requests the maximum frame relay length selection.

AUX:FRAME_RELAY:MIN_LENGTH xxxx
Sets the minimum frame relay length (where xxxx = 4 to 9999).

AUX:FRAME_RELAY:MIN_LENGTH?
Requests the minimum frame relay length selection.

AUX:FRAME_RELAY:TX_LOAD [OFF | BURST | FIXED | PING]
Sets the type of transmit load (where OFF = no transmission, BURST = transmission for the burst time, FIXED = the set rate (in kb/s) up to 10 Mb/s, and PING = enable PING function).

AUX:FRAME_RELAY:TX_LOAD?
Requests the TX load selection.

AUX:FRAME_RELAY:TX_LOAD:PING_DEST "xxx.xxx.xxx.xxx"
Sets the IP destination address (where xxx = 000 to 255).

AUX:FRAME_RELAY:TX_LOAD:PING_DEST?
Requests the IP destination address.

AUX:FRAME_RELAY:TX_LOAD:PING_ADDR_MODE [DYNM | STAT]
Sets the IP addressing mode (where DYNM = enables automatic IP addressing using InARP messages and STAT = enables manual selection of the IP address).

AUX:FRAME_RELAY:TX_LOAD:PING_ADDR_MODE?
Requests the IP addressing mode.

AUX:FRAME_RELAY:TX_LOAD:PING_ENCAP [NONE | NLPID | ETHER]
Sets the encapsulation format (where NONE = off, NLPID = Network Layer Protocol Identification encapsulation enabled, and ETHER = Ethertype only encapsulation enabled).

AUX:FRAME_RELAY:TX_LOAD:PING_ENCAP?
Requests the encapsulation format.

AUX:FRAME_RELAY:TX_LOAD:PING_LENGTH nnnn
Sets the IP packet length (where nnnn = 34 to 2000).

AUX:FRAME_RELAY:TX_LOAD:PING_LENGTH?
Requests the IP packet length.

AUX:FRAME_RELAY:TX_LOAD:PING_SRC "xxx.xxx.xxx.xxx"
Sets the IP source address (where xxx = 000 to 255).

AUX:FRAME_RELAY:TX_LOAD:PING_SRC?
Requests the IP source address.

F.8.1 Results Commands

Below is a list the syntax for the results which can be used with the various FIREBERD 6000 Results commands/queries.

RESULT NAME	SYNTAX	RESULT NAME	SYNTAX
TX PNG	tx_ping	LOST PNG	lost_ping
ECHO PNG	echo_ping	MIN PNG	min_ping_rtd
MAX PNG	max_ping_rtd	AVG PNG	avg_ping_rdt
FRM CNT	frm_cnt	FRM OCTS	frm_octs
FRM RATE	frm_rate	AVG FRM	avg_frm
FCS ERRS	fcs_errs	ABRT FRM	abrt_frm
SHRT FRM	shrt_frm	FECN FRM	fecn_frm
BECN FRM	becn_frm	DE FRM	de_frm
LOST FRM	lost_frm	LMI MSGS	lmi_msgs
LMI ENQA	lmi_enqs	LMI STAT	lmi_stat
LMI ERRS	lmi_errs	LMI TMOS	lmi_tmos
PVC STAT	pvc_stat	AVG%UTIL	avg%util
MAX%UTIL	max%util	AVG TPUT	avg_tput
MAX TPUT	max_tput		

F.9. FRAME RELAY TECHNOLOGY

Frame relay is a protocol that is used to provide access to the public network. The FIREBERD 6000 tests the frame relay protocol at any User Network Interface (UNI) or Network-Network Interface (NNI) access points. In other words, frame relay is tested between user devices (i.e., routers, bridges, or host machines) and network equipment (i.e., switching nodes) and between any two pieces of network equipment. User devices are commonly referred to as DTE (Data Terminal Equipment), while network equipment that interfaces with the DTE is referred to as DCE (Data Circuit-terminating Equipment).

Frame relay is a streamlined protocol since it does not provide for error correction. It provides higher performance and greater efficiency, allowing greater throughput and bandwidth on demand. Frame relay accomplishes this by statistically multiplexing many logical data conversations (called virtual circuits) over a single physical transmission link. This statistical multiplexing provides a more flexible and efficient utilization of available bandwidth.

Due to recent improvements in digital transmission technology, wide area networks have produced transmission links with BERs (Bit Error Rates) of 1 in 100,000,000 bits. As a result of low BERs, Data Link Layer (Layer 2 of the ISO Reference Model) protocols can forego the link-by-link error correction algorithms, leaving this function to be performed by higher layers of protocol when necessary. This allows for greater performance and efficiency without sacrificing data integrity.

Frame relay was designed with this approach in mind. Frame relay provides a FCS (Frame Check Sequence) for the purpose of detecting corrupted data bits, but does not provide any means for correcting errors. Corrupted frames are simply discarded as they are encountered. Due to the widespread use of higher layer protocols used to perform flow control, frame relay does not include explicit flow control procedures, since doing so would be redundant with those in higher layers. However, frame relay does provide a very simple congestion notification mechanism to allow a network to inform a user device (DTE) when the network has reached a congested state.

The frame relay frame is shown in Figure F-9 and is delimited by flags at the beginning (opening flag) and ending of the frame (closing flag). All frame relay frames start and end with the following 8-bit flag sequence: one 0 bit followed by six consecutive 1 bits and one 0 bit.

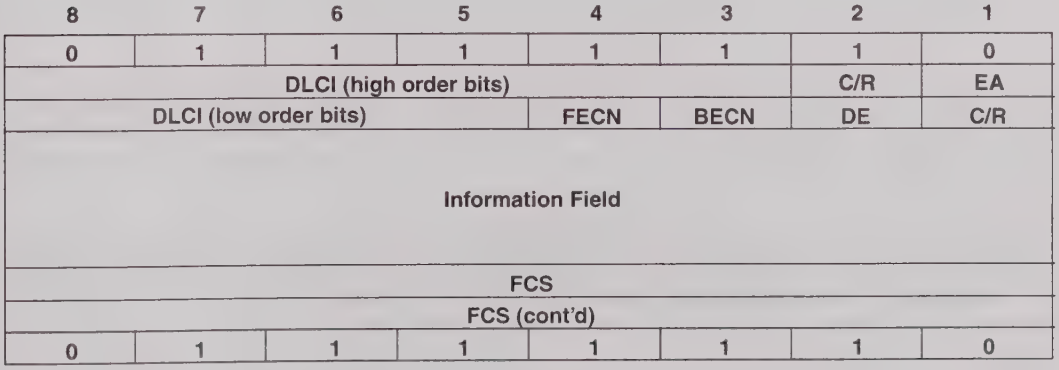

Figure F-9. Frame Relay Frame Format

The frame relay frame is transmitted from left to right and the octets are transmitted from top to bottom and is described as follows:

DLCI — Data Link Connection Identifier Address field (the MSB is Bit 8 in Octet 2 and the LSB is Bit 5 in Octet 3). The DLCI values available for use are determined by the service being provided.

C/R — Command/Response Indicator. The C/R bit, when implemented, is used (by the end user, not the network) to indicate whether the frame is a command or a response. Frame relay does not make use of this bit.

FECN — Forward Explicit Congestion Notification. The FECN bit is set by the network to notify the user that congestion avoidance procedures should be initiated, where applicable, for traffic in the direction of the frame carrying the FECN notification. The FECN bit is set to 1 in the direction of the congestion to notify the user that the network is congested. This bit is set to 1 to indicate to the receiving end-system that the frames it is receiving have encountered congested resources.

BECN — Backward Explicit Congestion Notification. The BECN bit is set by the network to notify the user that congestion avoidance procedures should be initiated, where applicable, for traffic in the opposite direction of the frame carrying the BECN notification. The BECN bit is set to 1 in the opposite direction of the congestion to notify the user that the network is congested. This bit is set to 1 to indicate to the receiving end-system that the frames it is transmitting have encountered congested resources.

EA — Address Field Extension Bit Indicator. The EA bit is the first bit of each octet (byte) of the address field. When the EA bit is set to 0, it indicates that another octet is following in the address field. When the EA bit is set to 1, it indicates that it is the last octet and that no other octet is following in the address field. The FIREBERD 6000 only supports 2 octet addresses.

DE — Discard Eligibility. The DE bit is set to 1 to indicate that this frame is eligible to be discarded instead of other frames when congestion is encountered. The network may discard a frame that has the DE bit set to 1 if the frame is routed across a point where congestion is occurring. However, if at the point where congestion is occurring and all frames with the DE bit set to 1 have been dropped and congestion still exists, the network will begin dropping frames that have their DE bit set to 0. The DE bit is typically set by the network when the user traffic has exceeded their negotiated parameters.

Information Field — User data. The information field contains the data that the user is transmitting. The maximum length of this field is determined by the service provider.

FCS — Frame Check Sequence. The FCS field is used to determine whether the address field and information field contain any errors. Frames with an invalid FCS are discarded by the network. The FCS is considered to be invalid when the FCS calculated on the received frame does not match the FCS within the frame.

Frame Abort — A frame with 7 or more consecutive 1 bits is a frame abort sequence. Upon receipt of the frame abort sequence, the network discards the frame. All received data following the Abort Frame is discarded, up until the next valid flag is received.

F.10. FRAME RELAY TESTING

You can use the Frame Relay option to:

- Perform complete physical layer testing of the local loop (or between nodes).
- Verify proper Link Management operation.
- Route frames across the network on a specific DLCI.
- Stress the network by transmitting frames (and monitoring at the receiving end).
- Non-intrusively monitor frame relay traffic on live data (excluding HSSI).
- Ping in-service routers and measure round trip delay.

Testing is considered to be intrusive (interrupting data) or non-intrusive (monitoring live data). Since intrusive testing is performed basically the same way as BER Physical Layer testing, only non-intrusive testing is discussed in the following paragraphs.

F.10.1 In-Service Monitoring

You can perform non-intrusive monitoring of live data by using the V.35 "Y" cable and the RS449/V.35/306/X.21 interface (Model 42522) or the V.35/306 DTE/DCE interface (Model 40202).

NOTE

When performing tests with the V.35 "Y" cable (Part No. 43013-01), the maximum data rate recommended is 2 Mb/s.

When monitoring a T1 circuit, you can also use a bridging cable, a DSX MON jack, or any available monitor access point. The following steps describe the procedure for performing in-service monitoring.

1. With the FIREBERD 6000 power turned OFF, insert the T1/FT1 interface in the vacant interface slot on the rear panel.
2. Turn ON the FIREBERD 6000 power.
3. Press the **MENU** switch until INTF SETUP illuminates. First set the T1/FT1 CONFIG and MODE parameters.
4. Press the **MENU** switch until the AUXILIARY LED illuminates.
5. Press the 1 and 2 keys on the keypad, then press **ENTER** to display the 12 FRAME RELAY auxiliary function. Be sure ON appears. If not, press the softkey below ON to enable the Frame Relay option.
6. Configure the link management for the frame relay circuit being monitored by pressing the LNKMGT softkey to display the selected link management. Be sure the displayed link management matches the link management for the frame relay circuit being monitored.
7. Adjust the link management interface to the opposite of what you are monitoring at the U interface. (i.e., select UNI-N when monitoring traffic from the DTE and select UNI-U when monitoring traffic from the switch).
8. As a precaution, verify that no frames are being transmitted by pressing the LOAD softkey. Be sure that OFF is displayed for the FRAME LOAD menu. If it is not, press the OFF softkey. (This is done since we are only monitoring data.)
9. Connect the bantam cable from the RX interface connector to the DSX MON jack to monitor data on the circuit you desire.

10. Press the **RESTART** key to clear any result values and begin monitoring live data.

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